Figure 1

Figure 2

Figure 3

Imag #2

File | Edit | Imag | Detect | Raster GIS | Hyperspectral Image | Imag PreProcessor | Help

Imag Package
Original Author: drhsu
Last Author: drhsu
Date Created: 05.26.2003 15:02 EDT
Date Modified: 05.26.2003 15:02 EDT
Package File: not specified

Imag Options
☐ Pause Images ☐ Show Script ☐ View/Band 1

Imag Image Script
Expert Systems | Expert Editor | Text Editor | Run

Imag Input Image Band Files
Band	File Name
1	/imag/data/pdo_images/pd1a.ton

Add Delete

Imag Output Base File Names
Band	File Name

Add Delete
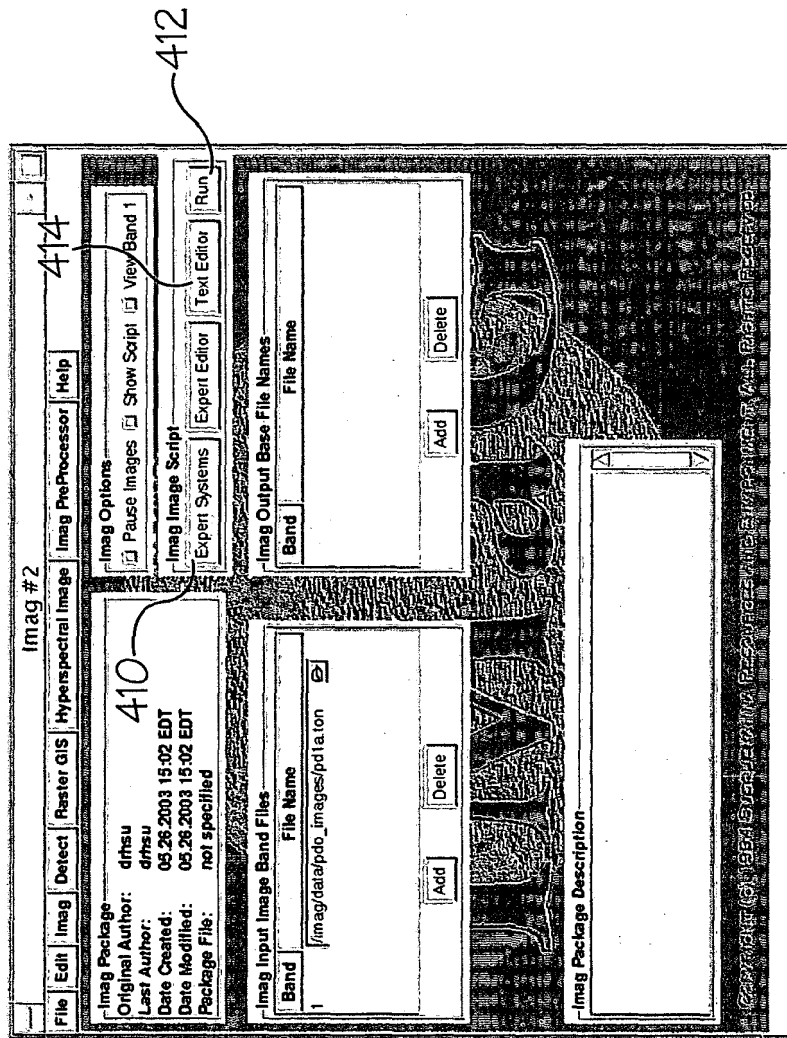
Imag Package Description

410
412
414

Figure 4

Expert Systems Browser

Model Type	Brief Description	Object Examples
⊞ Combined	Extract hybrid pixel/region object using cross band/layer FLIR 1249MD	
└		
⊞ Linear		
⊞ Mesotexture		
⊞ Pixel		
⊞	Bright Or Dark Object Feature Extraction	cars buses etc..
⊞	Both Bright & Dark Object Feature Extraction	cars buses etc..
⊕	Bright Or Dark Object Feature Extraction	cars buses etc..
⊕	Both Bright & Dark Object Feature Extraction	cars buses etc..
⊕	New Bright OR Dark Pixel Region Model	ground vehicles
	New Model For Visualization Using Two Input Bands	SAR vehicles (IPP,RAW)
⊞ Region		

510

Imag Systems Description

Exercise on Pixel based region and Rectangle based region for either dark or bright objects.

Enter Key Words:

Ok   Cancel   Search   Next

Figure 5

Pixel - Based Region Model

Filter Type
Filter For Band 1:
< Expand
> IQ Normalize
> Low Pass
> Median
> None

Object Of Interest
Object of interest name:
Item Name:
Guard distance around object:
Pixels: 2

Done   Quit

Object Charateristics
Type of object desired:
< Bright Object ⟋ 612
> Dark Object
Percent intensity of object: ⟍ 614

30 40 50 60 70 80 90 100
                              90

Minimum percent density required for object: ⟍ 616
        40

1 12 23 34 45 56 67 78 89 100

Search region size: ⟋ 618
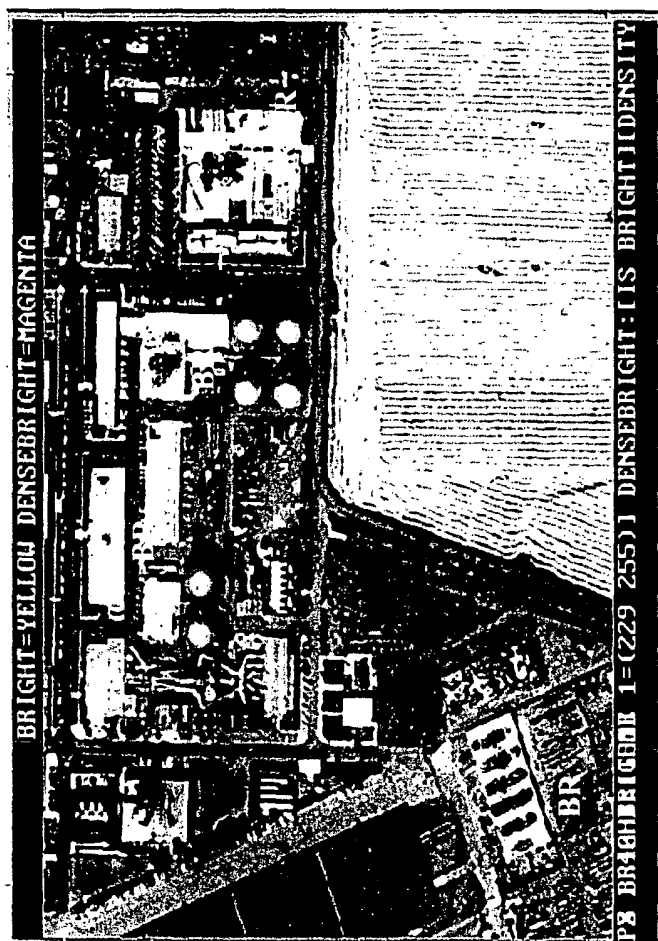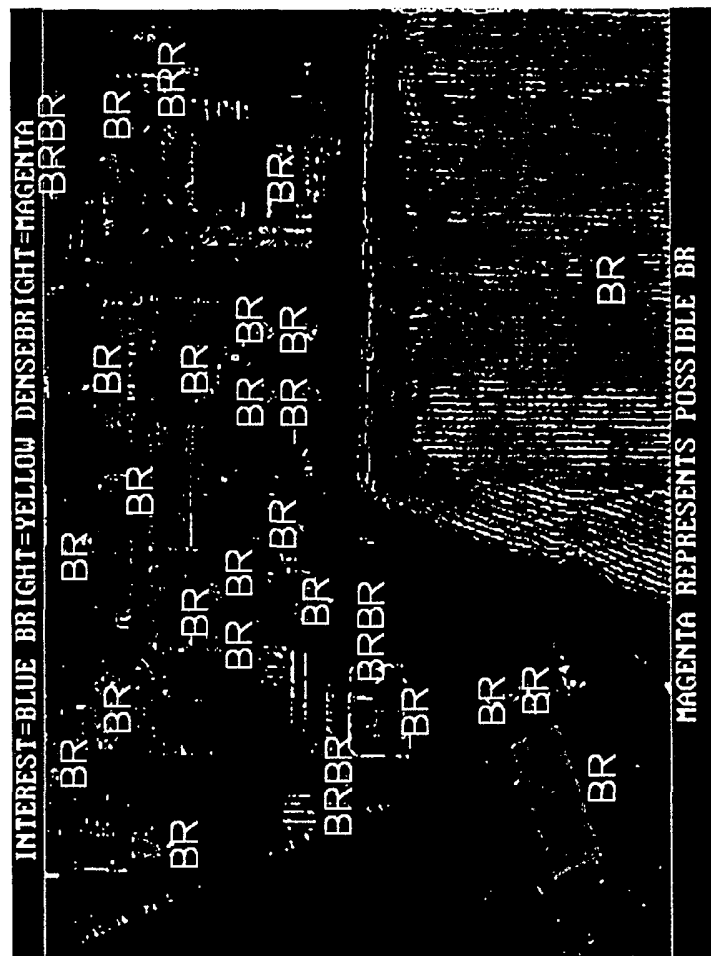Pixels: 3   By Pixels: 3

Run

620

Figure 6

Figure 7

Figure 8

Region Based Model

Filter Type
Filter to perform on band 1:
- Median
- Low Pass

Spatial Aspect
Merging of spatially contiguous objects:
Size of the FIRST object:
Upper Bound: 500
Lower Bound: 1
Size of the SECOND object:
Upper Bound: 500
Lower Bound: 1

Linearity
Degree of linearity:
Upper Bound: 10000
Lower Bound: 7000
Size of the linear object:
Upper Bound: 50000
Lower Bound: 100

Segmentation
Type of segmentation:
- Global Segmentation
- Local Segmentation

910

Nonlinearity
Degree of nonlinearity:
Upper Bound: 5000
Lower Bound: 0
Please select the size of the nonlinear object:
Upper Bound: 50000
Lower Bound: 100

Linearity For Moderate Objects
Degree of linearity for moderate objects:
Upper Bound: 7000
Lower Bound: 5000
Size of the moderately linear objects:
Upper Bound: 50000
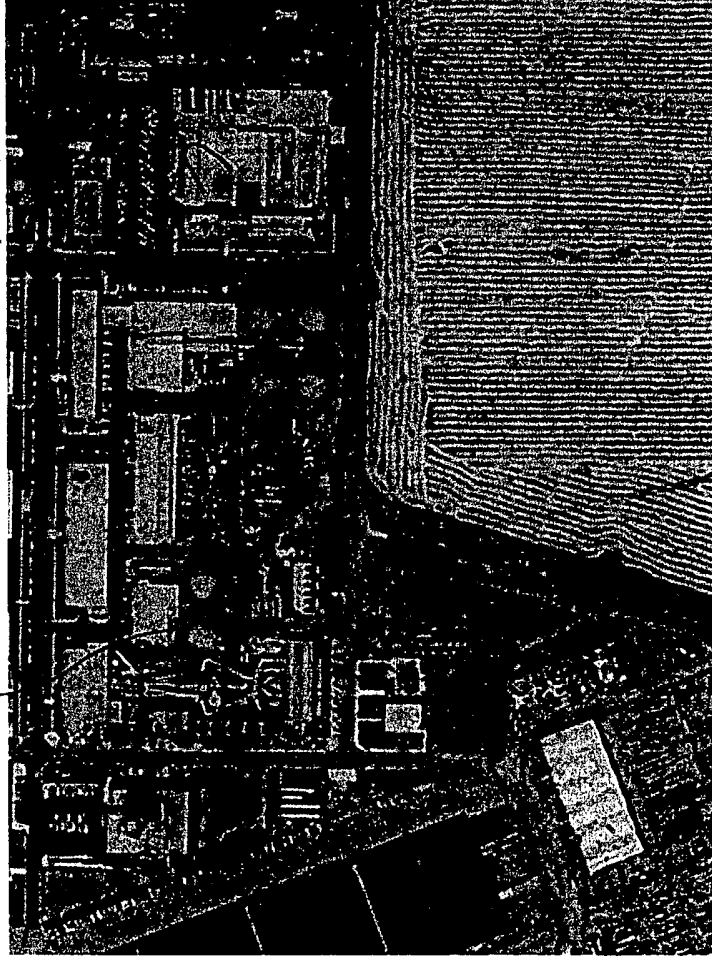Lower Bound: 100

Done   Quit   Run

912

Figure 9

1010

Figure 10

Id	Size	Tone	Row Cent	Col Cent	Row Min	Row Max	Col Min	Col Max	Convo	Elong	Constr	Linear	Aspect	Inclin	Textur	Deviat	Divers	Max Tone	Min Tone	Coord
1	172712	0	179.5	239.2	0	359	0	479	0	0	0	588	9424	0	0	0	0	0	0	(0,0) (359,479)
2	1	179	72.0	304.0	72	72	304	304	0	0	0	0	0	0	0	0	0	179	179	(72,304) (72,304)
3	87	145	97.4	158.7	92	103	154	163	0	0	0	360	10389	97	446	522	1703	153	121	(92,154) (103,163)

10a10

10a12

Figure 10A

LINEAR=YELLOW MODLINEAR=CYAN NONLINEAR=MAGENTA

LINEARITY: L(7000 10000) ML(5000 7000) NL(0 5000)

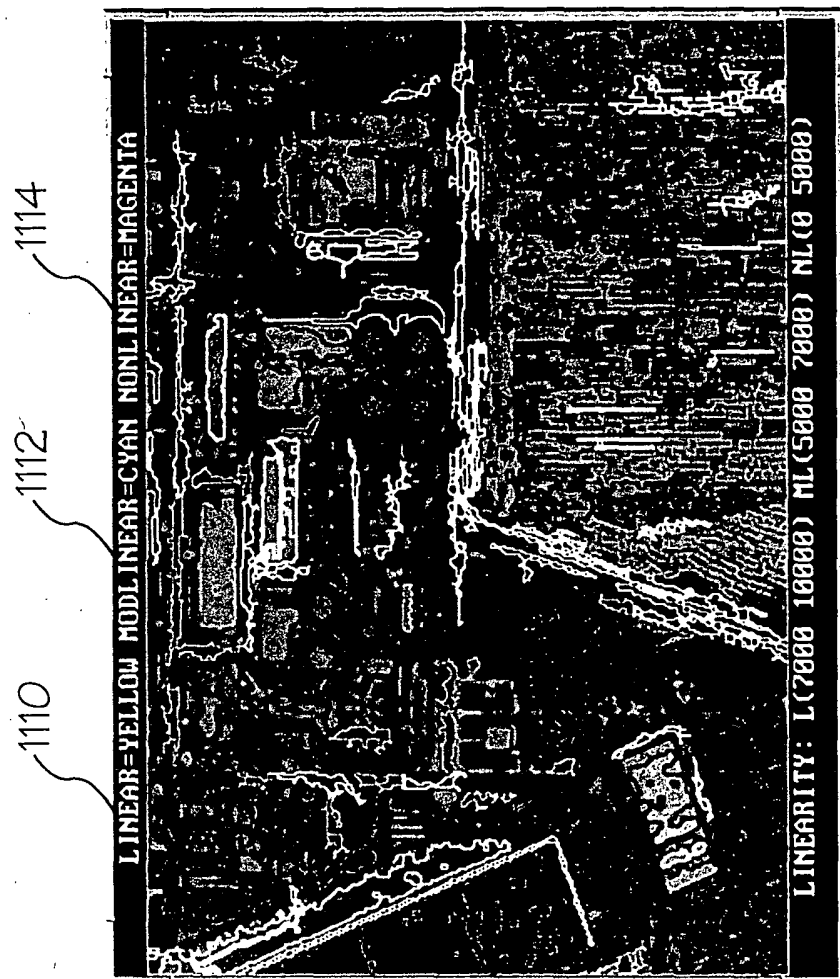Figure 11

```
File  Edit  Format  Options                                          Help

BANDS = 1;
MODIFY 1 = MEDIAN3;
modify 1 = expand ;

SHOW RULES = NO;
SHOW SEGMENTATION STATISTICS = NO;
SHOW MERGING STATISTICS = NO;
INITIAL CUTOFF = 5;
SEGMENTATION TYPE = local;
SHOW INITIAL SEGMENTATION = SLOW;
SHOW INITIAL SEGMENTATION = BW 50 65000;
MERGE = 40,1 STOP1 1;

SHOW #1 MERGE = SLOW;
SHOW #1 MERGE = BW 50 65000;
MERGE = 2 SPF = (1 500 1 500 -1000);
SHOW #2 MERGE = SLOW;
SHOW #2 MERGE = BW 50 65000;
SEEK LINEAR MODLINEAR NONLINEAR;
Seek small_dark_region non_linear_bright possible_tank;
REGION LINEAR: [#1 SIZE = (100 50000)] [#1 LINEARITY = (7000 10000)];
REGION MODLINEAR: [#1 SIZE = (100 50000)] [#1 LINEARITY = (5000 7000)];
REGION NONLINEAR: [#1 SIZE = (100 50000)] [#1 LINEARITY = (0 5000)];
       /* This is the object we are interested */
region small_dark_region: [#1 tone = (0 20)][#1 size = (50 1000)];
region non_linear_bright: [is nonlinear][#1 tone = (200 255)];
       /* those are new objects defined */
TOP TITLE = "LINEAR=YELLOW MODLINEAR=CYAN NONLINEAR=MAGENTA" ;
BOTTOM TITLE = "LINEARITY: L(7000 10000) ML(5000 7000) NL(0 1000)" ;

DISPLAY LINEAR=YELLOW MODLINEAR=CYAN NONLINEAR=MAGENTA;
BW 1 DISPLAY LINEAR=YELLOW MODLINEAR=CYAN NONLINEAR=MAGENTA;
BW 1 DISPLAY NONLINEAR=MAGENTA;
top title = "possible_tank=magneta small_dark=yellow" ;

bw 1 display nonlinear=magenta small_dark=yellow;
bw 1 display possible_tank=red;
```
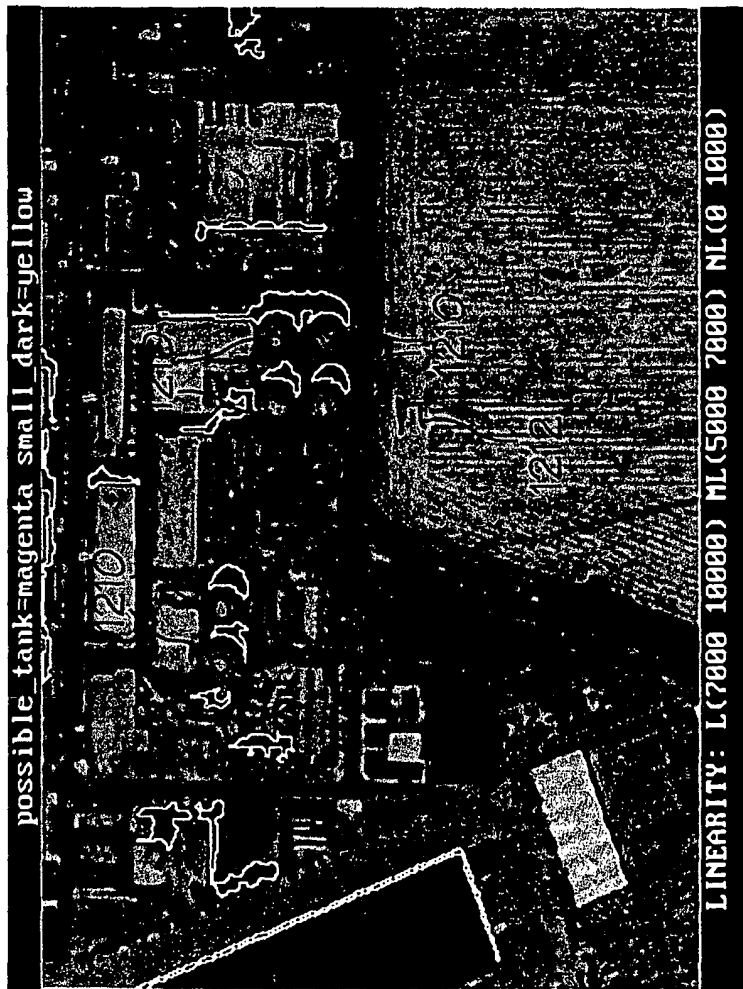
Figure 11A

Figure 12

Figure 13

1410
Region Twentythree23: [is Two2][left Three3] 1410
[approaches 30 Three3]; 1414

TOP TITLE = "23=yellow Three3=cyan";
Bottom Title = " " " ;

Display Twenthree23=yellow Three3=cyan;
BW 1 Display Twentythree23=yellow Three3=cyan;

Figure 14

Figure 15

A Hyperspectral Spectral Signature
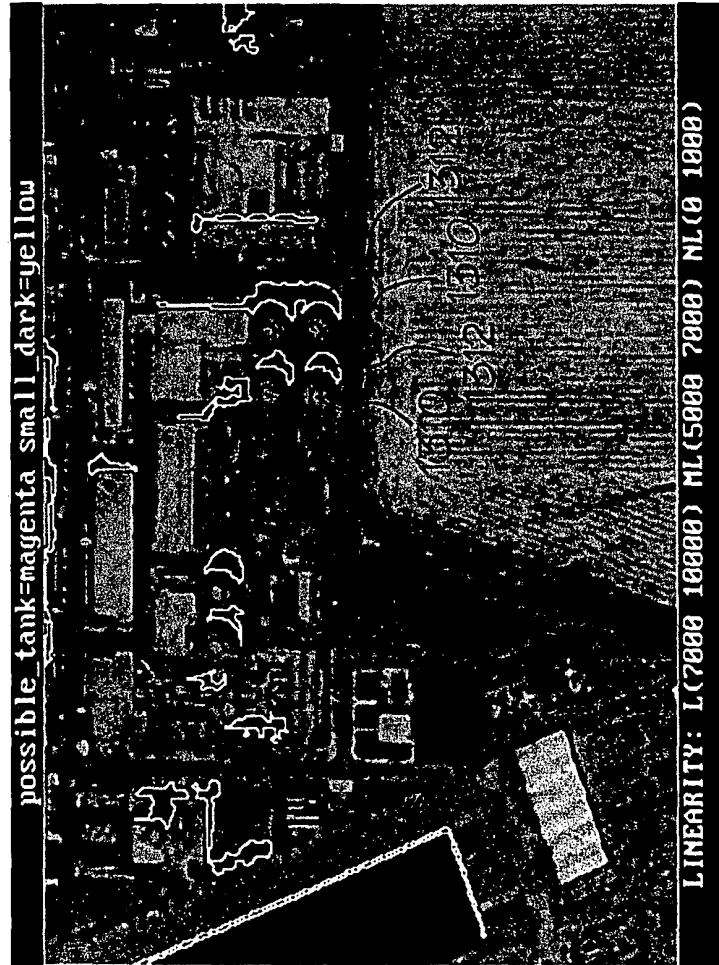
Reflectance (%)

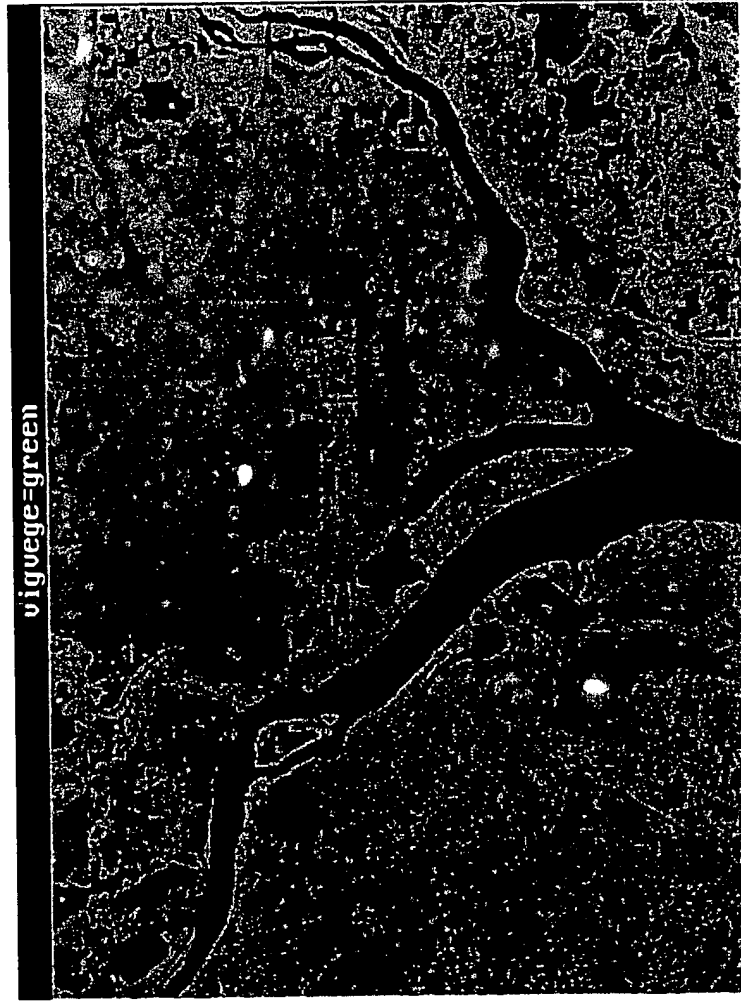Band ID or Spectral Region (micron)

Figure 16

viguege=green
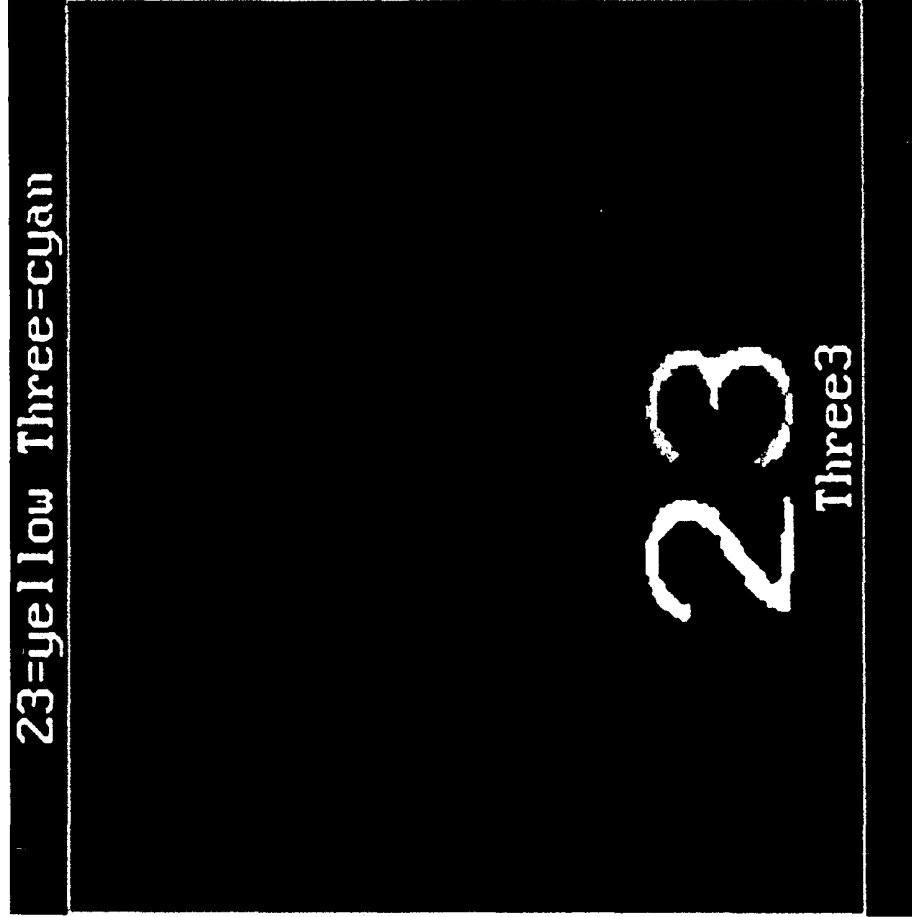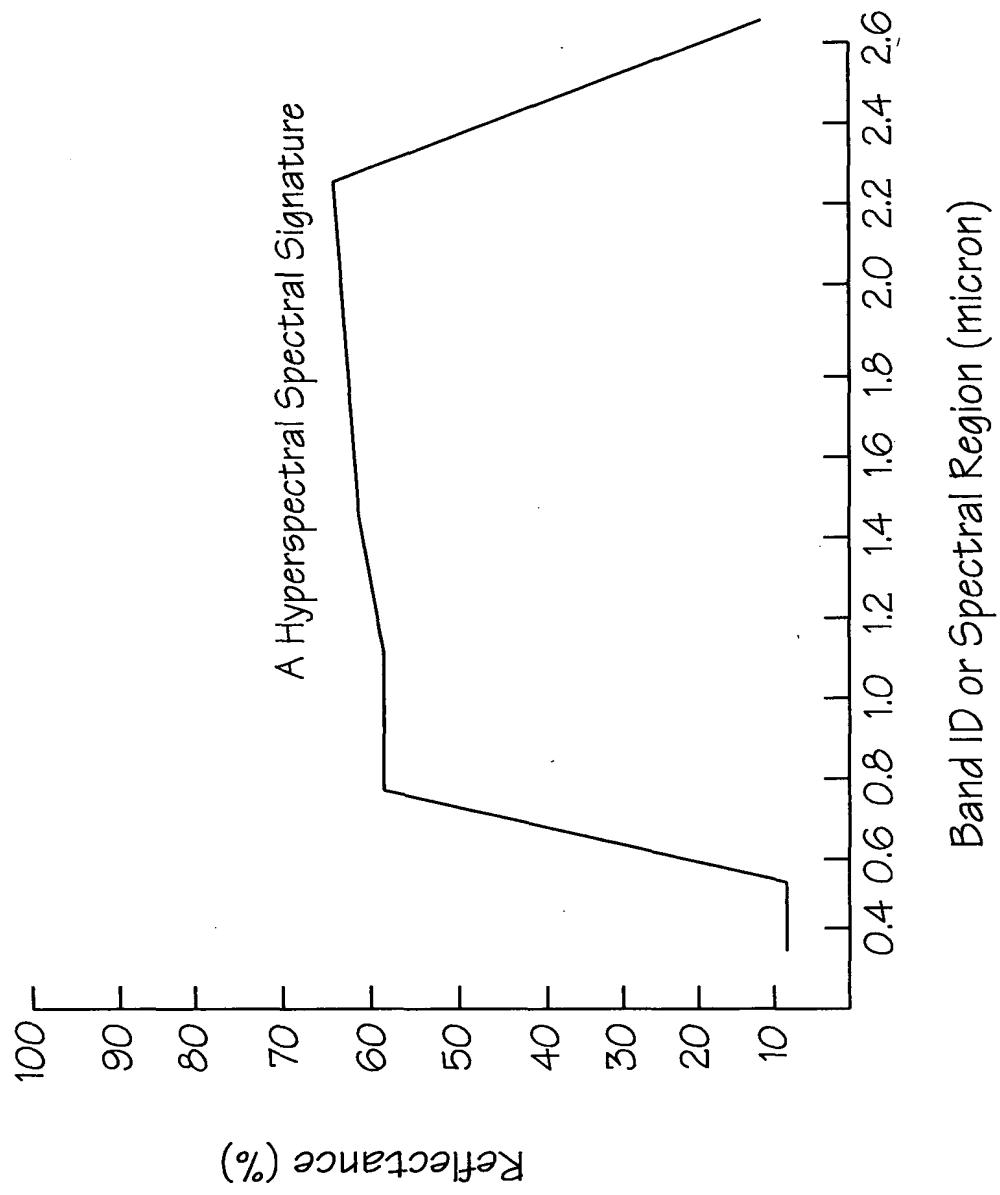
Figure 17

```
/*
*/

/*
*/

BANDS = 9;
/* total number of band 91 with only 7 input bands, 2 additional
Bands are to be generated by IMaG. */

Modify 6 = expand;
/*band 6, thermal is expanded to a full 0=255 range */

BAND 8 = 0.85468 * :4: = 0.05493 * :5: - .24717 * :1: _ .6263 * :2:
       - .40639 * :3: - .11749 * :7:;

/* a greenness transform formula */

BAND 9 = (:6: > 140) * 250 ;
/* band 9 is defined by using band 6 as the base;
Any pixel with intensity value > 140 is coded as 250 */
```
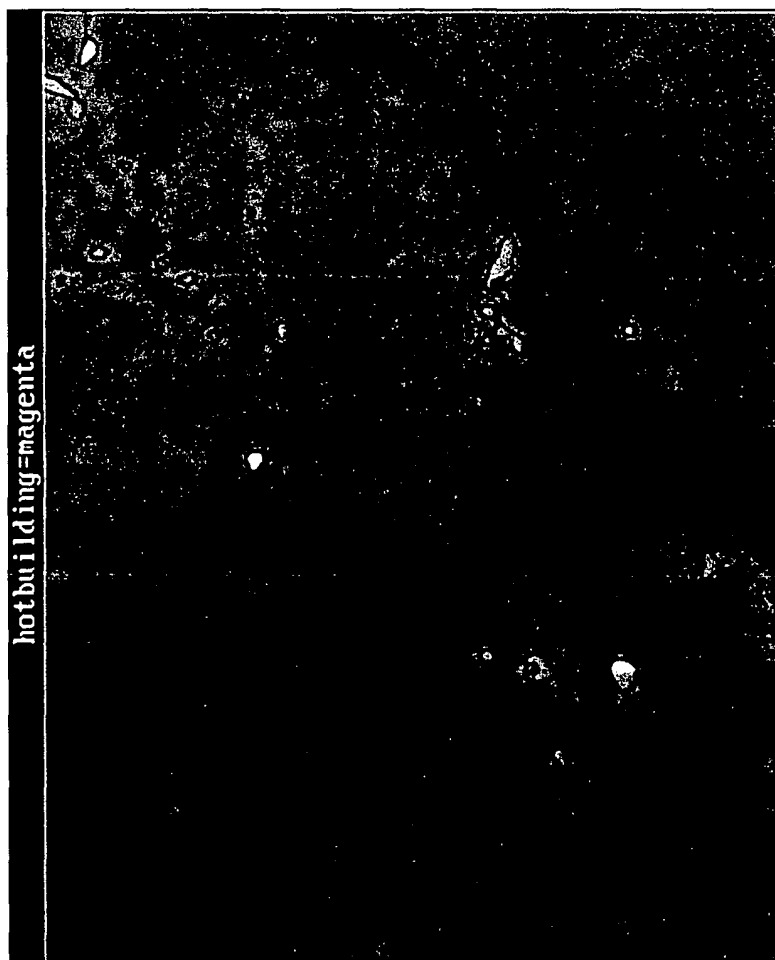
17a10

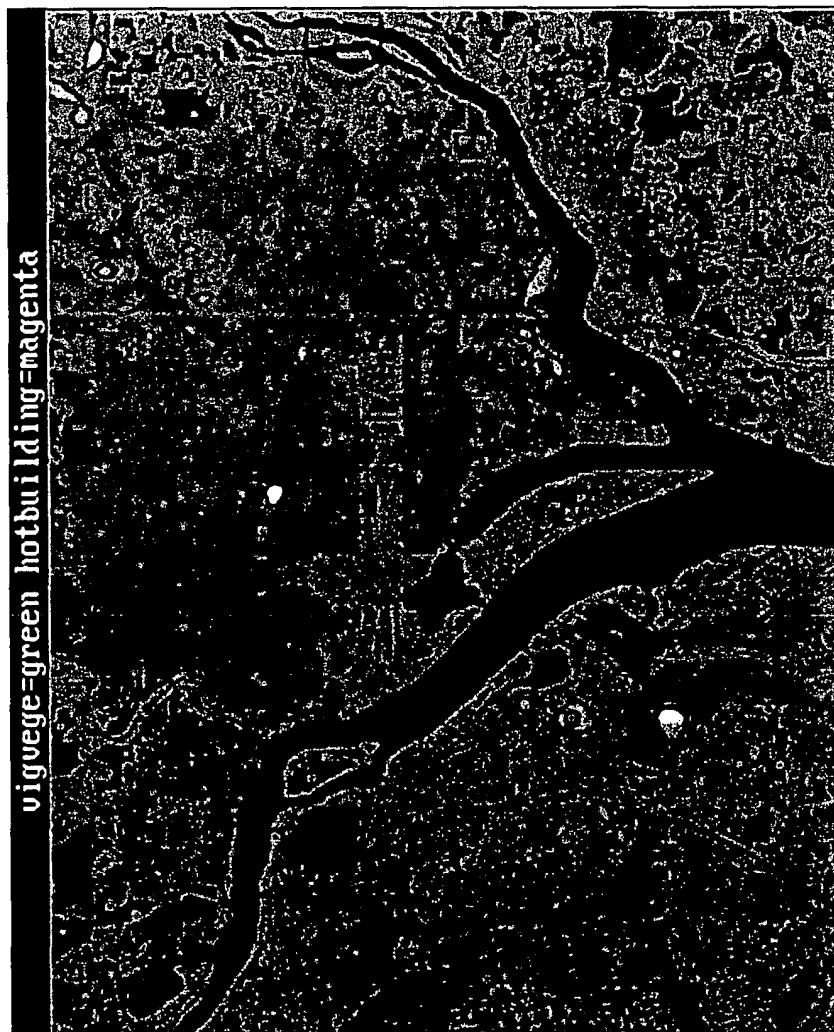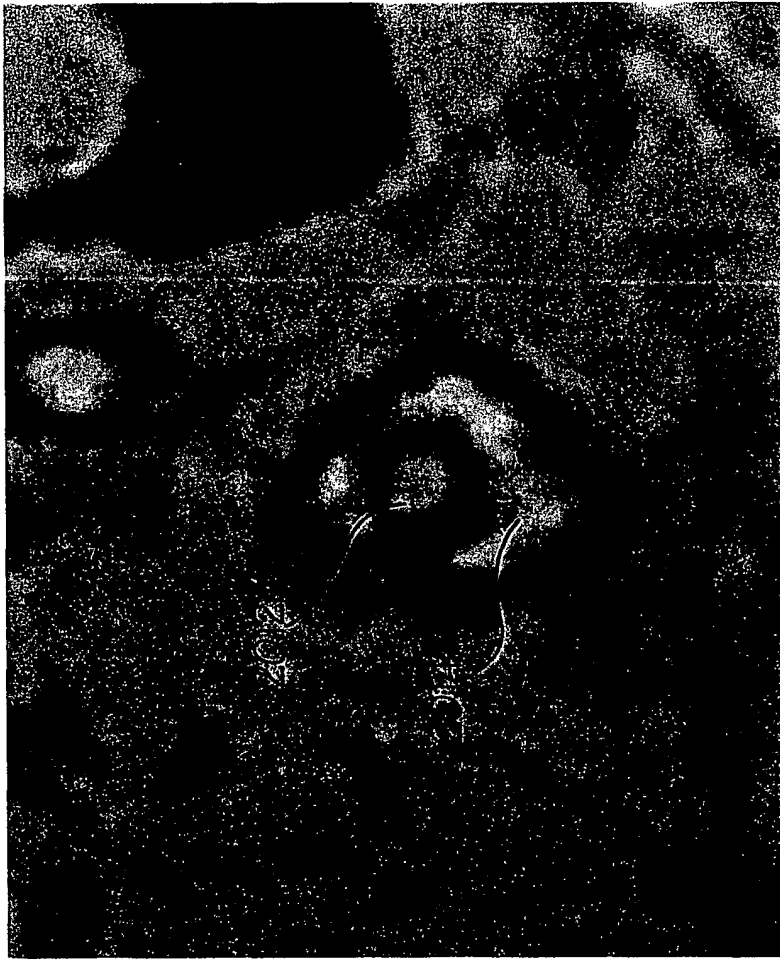17a12

Figure 17A

hotbuilding=magenta

Figure 18

vigvege=green hotbuilding=magenta

Figure 19

Figure 20

Figure 21

Figure 22

Field #1

Feature Extraction

-- usually done by using a Rule Base
* Usually articulatable

Field #2

Automated Target Recognition

-- usually done by a matcher
• Usually not articulatable

IMaG Language

2310

2312

101

Feature Extraction

Confidence level 1

2314a

Automated Target Recognition

Confidence level 2

2314b

2314

Combined Object with Altered Confidence Level
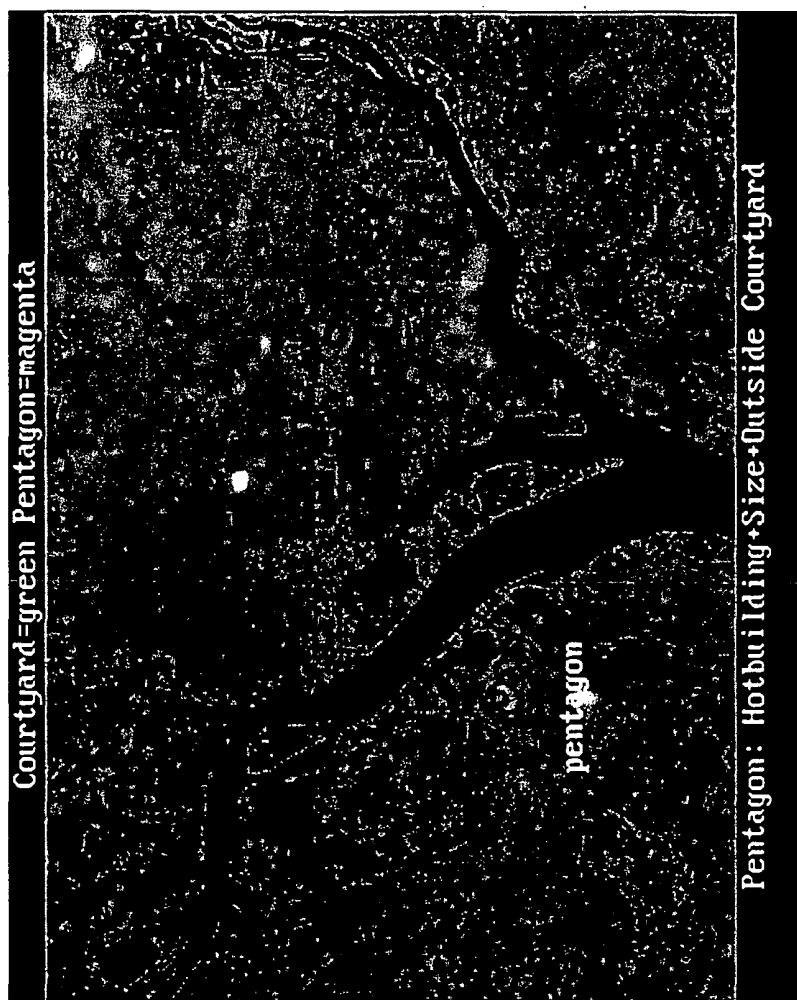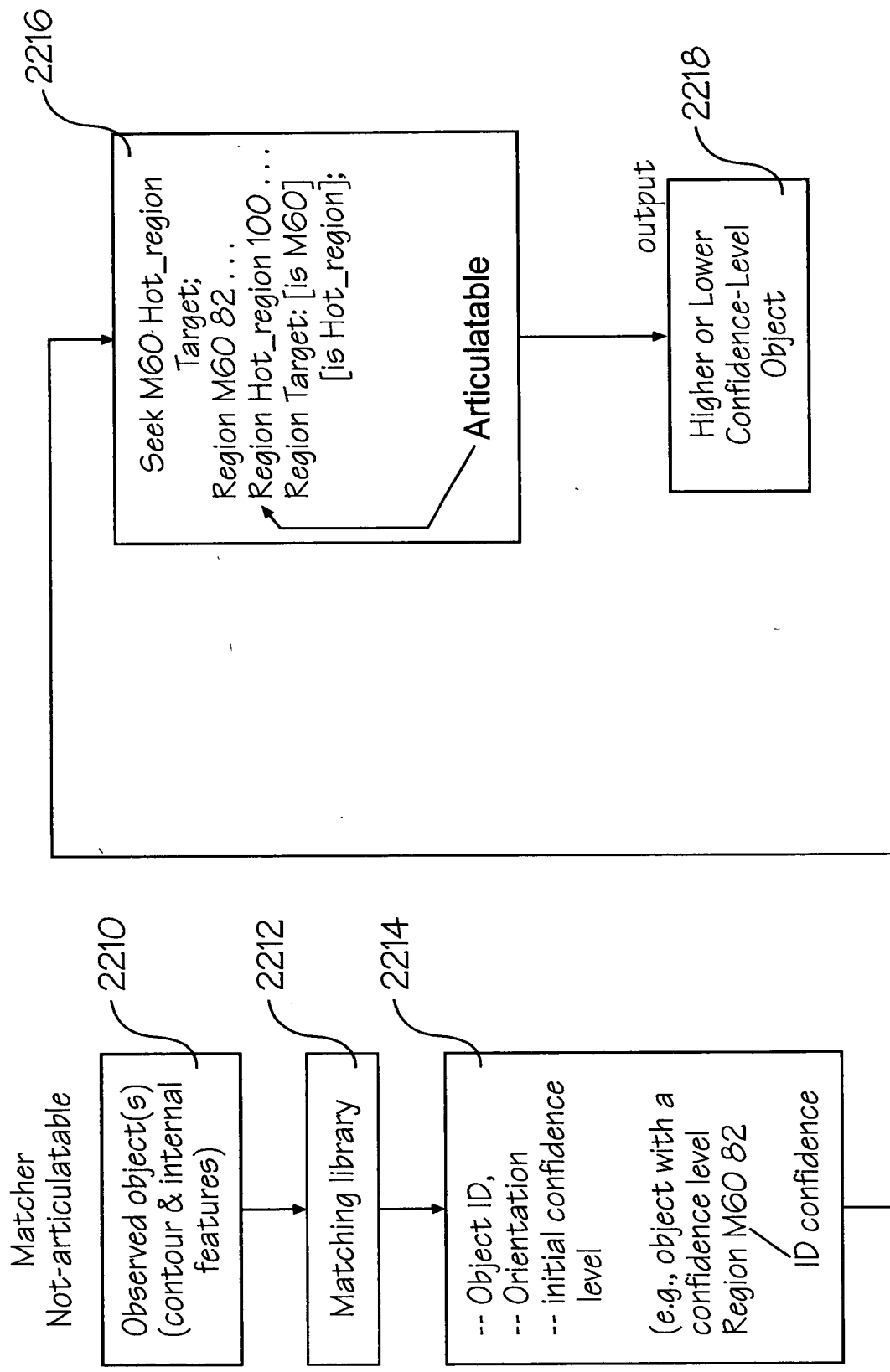
2316
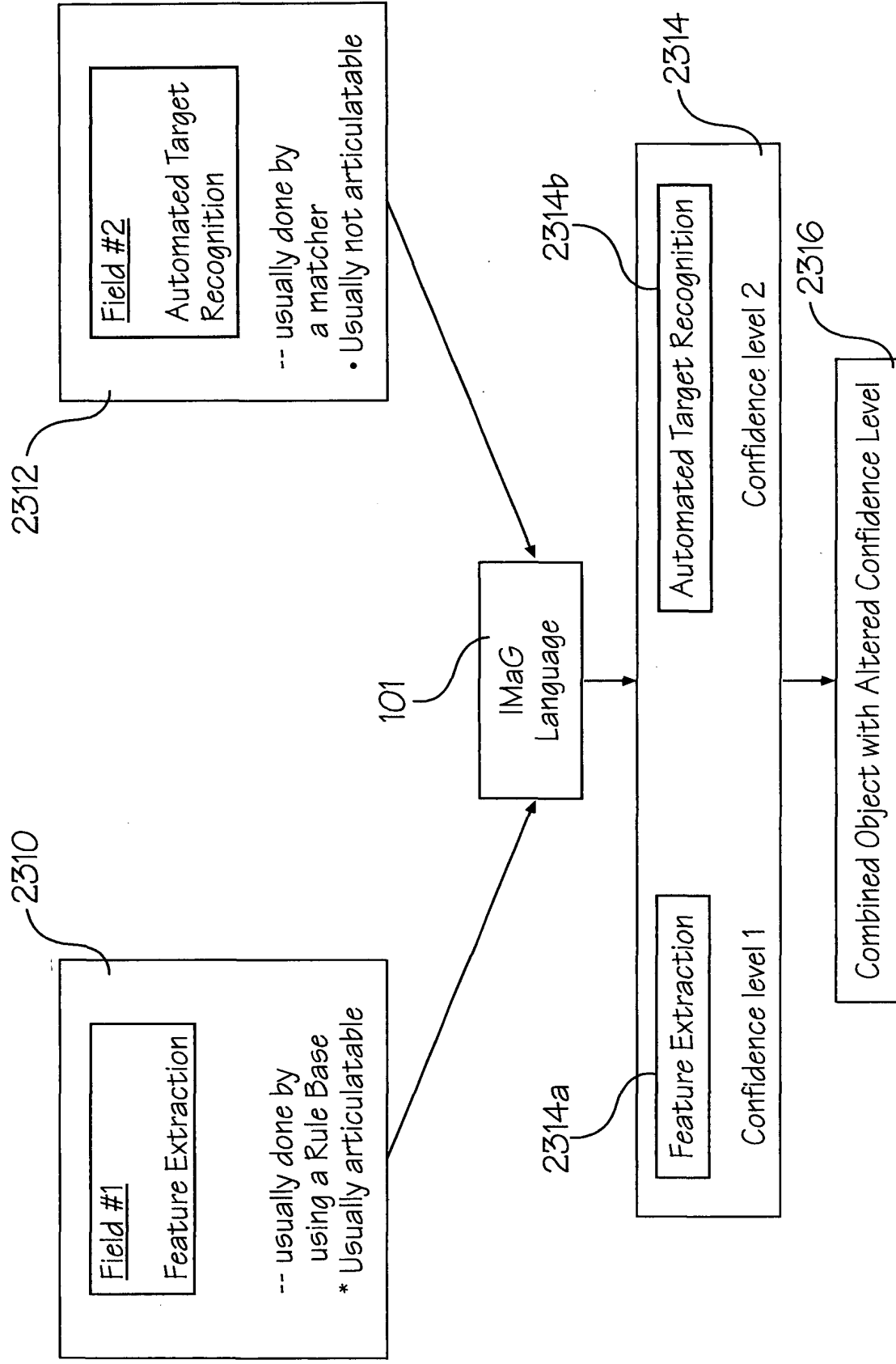
Figure 23

Seek Small_round_region Bright_region Sbr2dk ;
2410

Region Small_round_region 90:
[#0 size 1 = (40 500)]
[#0 elongation 1 - () 300)];
2414

Region Bright_region 70 : [#0 tone 1 = (120 255)];
2416

Region Sbr2dk: [is Small_reound_region]
[is Bright_region];
2418

Top Title = "display sbr2dk=green, 50 sb22dk=red, 70" ;
Bw 1 display sbr2dk=green,50 sbr2dk=red,70 ;
2420   2422

2414   2414

2416

Figure 24

display sbr2dk=green, 50 sbr2dk=red,70

Figure 25

```
Text Editor - tmp.9018.0

File  Edit  Format  Options                                    Help

Seek small_round_region bright_region sbr2dk;

Region small_round_region 90: [#1 size = (50 500)]
                               [#1 elongation 1 = (0 300)];

Region bright_region 70: [#1 tone 1 = (120 255)];

Region sbr2dk: [is small_round_region] 2610
               [is bright_region];

Top title = "display sbr2dk=green, 70 sbr2dk=red,80" ;
                                   2612        2614

bw 1 display sbr2dk=green,70 sbr2dk=red,80 ;
                           2612        2616
```
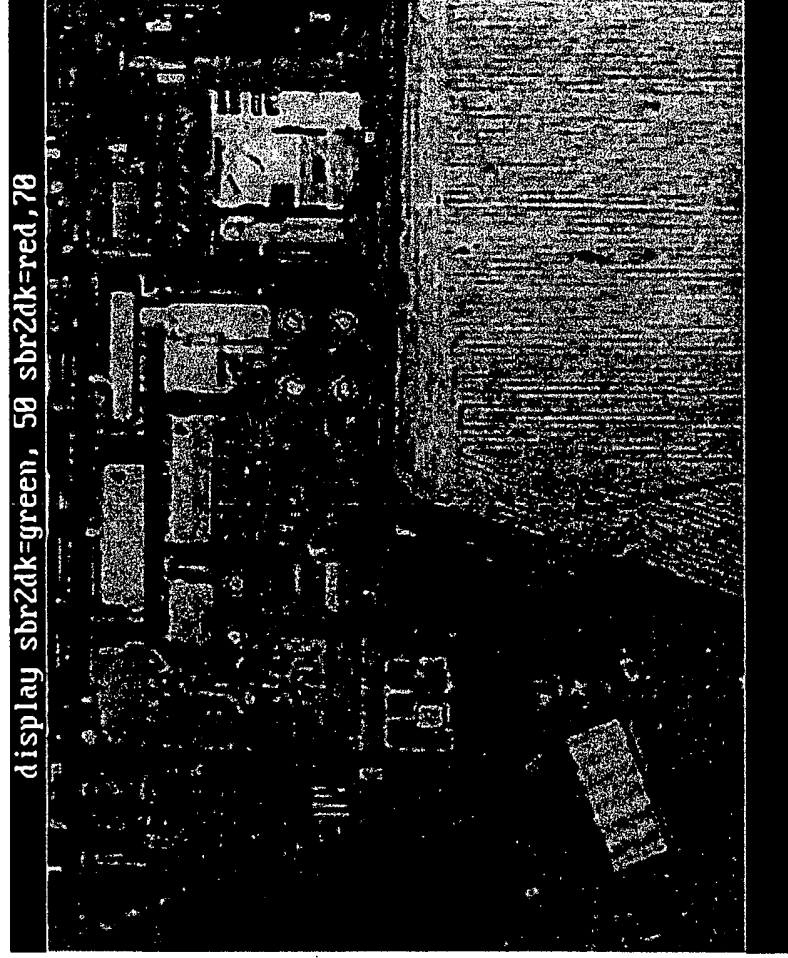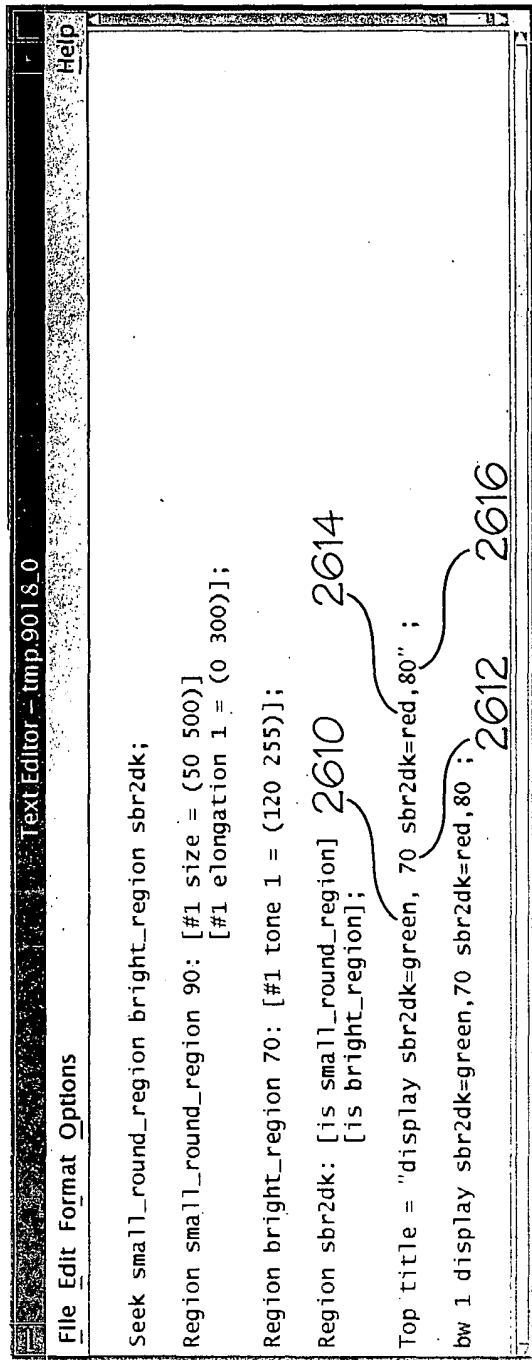
Figure 26

display sbr2dk=green, 70 sbr2dk=red,80

Figure 27